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Rec'd - 1-2d-79

300 - Lloyna Miller

FIELD REFERENCE HANDBOOK

FOR

SERVICE FORESTERS

NORTHEASTERN AREA
STATE & PRIVATE FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

see Revision

NA-FR-15

NA-FR-2

CONTENTS

	Page
International Tree Scale	1
Scribner Tree Scale	2
Doyle Tree Scale	3
International Log Scale	4
Scribner Log Scale	5
Doyle Log Scale	6
Comparison of Log Rules	7
Pulpwood Tree Measurement	8
Lumber Scale	9
Stave Bolt and Heading Volumes in Standing Trees	10
Shortcut Formulas: Cruising Pulpwood	11
Shortcut Formulas: Cruising Sawtimber	12
Computing Volume By Using Basal Area Ratios	13
Quick Cruise Computer--Cords	14
Quick Cruise Computer--Board Feet	15
Quick Cruise Computer--Tons - 2.2 Tons Per Cord	16
Quick Cruise Computer--Tons - 2.5 Tons Per Cord	17
Quick Cruise Computer--Tons - 2.7 Tons Per Cord	18
Weight Table For Various Woods	19
Sugar Maple Tap Hole Computation Sheet	20
Growth Factor Table	21
Shortcut Calculations For Growth	22
Upland Central Hardwood Stocking Charts	23 & 24
Upland Central Hardwood Spacing Table	25
Even-Aged Northern Hardwood Stocking Chart	26
TSI Rules-of-Thumb and Rough Averages	27
Estimated Cost Per Tree For Pruning Pine	28
Compound Interest Table	29
Number of Trees Per Acre By Various Spacings	30
Basal Area Table	31
Tree Requirements	32
Number of Stems Per Acre By Diameter & Basal Area	33

☆GPO: 1979—604-661/585 2-1

TREE SCALE
(International 1/4 Inch)

DBH	Number of 16-Foot Logs							
	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4
	Contents in Board Feet							
12"	30	60	80	100	120			
14"	40	80	110	140	160	180		
16"	60	100	150	180	210	250	280	310
18"	70	140	190	240	280	320	360	400
20"	90	170	240	300	350	400	450	500
22"	110	210	290	360	430	490	560	610
24"	130	250	350	430	510	590	660	740
26"	160	300	410	510	600	700	790	880
28"	190	350	480	600	700	810	920	1020
30"	220	410	550	690	810	930	1060	1180
32"	260	470	640	790	940	1080	1220	1360
34"	290	530	730	900	1060	1220	1380	1540
36"	330	600	820	1010	1200	1380	1560	1740
38"	370	670	910	1130	1340	1540	1740	1940
40"	420	740	1010	1250	1480	1700	1920	2160
42"	460	820	1100	1360	1610	1870	2120	2360

Rule-of-Thumb For Determining Volume

3-Log Trees: DBH x DBH

More than 3-log tree: DBH (DBH + 3 for each 1/2 log above 3 logs)

Less than 3-log tree: DBH (DBH - 3 for each 1/2 log under 3 logs)

TREE SCALE
(Scribner)

DBH	Number of 16-Foot Logs						
	1	1 1/2	2	2 1/2	3	3 1/2	4
	Contents in Board Feet						
12"	47	61	75	85	95	100	106
14"	69	92	114	130	146	156	166
16"	95	127	159	185	211	229	247
18"	123	166	209	244	280	306	331
20"	157	214	270	317	364	398	432
22"	194	266	338	398	458	504	549
24"	234	322	409	484	558	611	665
26"	281	388	494	585	676	745	814
28"	327	452	578	686	795	877	959
30"	382	530	678	806	933	1028	1124
32"	440	612	784	936	1089	1206	1322
34"	498	695	892	1066	1239	1373	1507
36"	563	789	1015	1216	1416	1572	1728
38"	629	882	1135	1366	1596	1769	1942
40"	703	988	1274	1532	1791	1993	2195

TREE SCALE
(Doyle)

DBH	Number of 16-Foot Logs							
	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4
	Contents in Board Feet							
12"	20	30	40	50	60			
14"	30	50	70	80	90	100		
16"	40	70	100	120	140	160	180	190
18"	60	100	130	160	200	220	240	260
20"	80	130	180	220	260	300	320	360
22"	100	170	230	280	340	380	420	460
24"	130	220	290	360	430	490	540	600
26"	160	260	360	440	520	590	660	740
28"	190	320	430	520	620	710	800	880
30"	230	380	510	630	740	840	940	1040
32"	270	440	590	730	860	990	1120	1220
34"	300	510	680	850	1000	1140	1300	1440
36"	350	580	780	970	1140	1310	1480	1640
38"	390	660	880	1100	1290	1480	1680	1860
40"	430	740	990	1230	1450	1660	1880	2080
42"	470	830	1100	1370	1620	1860	2100	2320

LOG SCALE
(International 1/4 Inch)

Diameter (Inches)	Length of Log (feet)					
	6	8	10	12	14	16
	Contents in Board Feet					
6	5	10	10	15	15	20
7	10	10	15	20	25	30
8	10	15	20	25	35	40
9	15	20	30	35	45	50
10	20	30	35	45	55	65
11	25	35	45	55	70	80
12	30	45	55	70	85	95
13	40	55	70	85	100	115
14	45	65	80	100	115	135
15	55	75	95	115	135	160
16	60	85	110	130	155	180
17	70	95	125	150	180	205
18	80	110	140	170	200	230
19	90	125	155	190	225	260
20	100	135	175	210	250	290
21	115	155	195	235	280	320
22	125	170	215	260	305	355
23	140	185	235	285	335	390
24	150	205	255	310	370	425
25	165	220	280	340	400	460
26	180	240	305	370	435	500
27	195	260	330	400	470	540
28	210	280	355	430	510	585
29	225	305	385	465	545	630
30	245	325	410	495	585	675

FORMULA: $.05\ (D-1)^2 \times L$

LOG SCALE
(Scribner)

Diameter (Inches)	Length of Log (feet)					
	6	8	10	12	14	16
	Contents in Board Feet (tens)					
8	1	1	2	2	2	3
9	1	2	3	3	3	4
10	2	3	3	3	4	6
11	2	3	4	4	5	7
12	3	4	5	6	7	8
13	4	5	6	7	8	10
14	4	6	7	9	10	11
15	5	7	9	11	12	14
16	6	8	10	12	14	16
17	7	9	12	14	16	18
18	8	11	13	16	19	21
19	9	12	15	18	21	24
20	11	14	17	21	24	28
21	12	15	19	23	27	30
22	13	17	21	25	29	33
23	14	19	23	28	33	38
24	15	21	25	30	35	40
25	17	23	29	34	40	46
26	19	26	31	37	44	50
27	21	27	34	41	48	55
28	22	29	36	44	51	58
29	23	31	38	46	53	61
30	26	33	41	49	57	66

LOG SCALE
(Doyle)

Diameter (Inches)	Length of Log (feet)					
	6	8	10	12	14	16
	Contents in Board Feet					
8	6	8	10	12	14	16
9	9	13	16	19	22	25
10	14	18	23	27	32	36
11	18	25	31	37	43	49
12	24	32	40	48	56	64
13	30	41	51	61	71	81
14	38	50	63	75	88	100
15	45	61	76	91	106	121
16	54	72	90	108	126	144
17	63	85	106	127	148	169
18	74	98	123	147	172	196
19	84	113	141	169	197	225
20	96	128	160	192	224	256
21	108	145	181	217	253	289
22	122	162	203	243	284	324
23	135	181	226	271	316	361
24	150	200	250	300	350	400
25	165	221	276	331	386	441
26	182	242	303	363	424	484
27	198	265	331	397	463	529
28	216	288	360	432	504	576
29	234	313	391	469	547	625
30	254	338	423	507	592	676

FORMULA: $\left(\frac{D - 4}{4}\right)^2 \times L$

Comparison of Log Rules

Top Diameter Inside Bark (inches)	Board foot values for 16-foot logs for log rules and in percentage of International 1/				
	International ¼ kerf	Scribner Decimal C		Doyle	
	Bd. Ft.	Bd. Ft.	Percent	Bd. Ft.	Percent
8	40	30	75	16	40
9	50	40	80	25	50
10	65	60	92	36	55
11	80	70	88	49	61
12	95	80	84	64	67
13	115	100	87	81	70
14	135	110	81	100	74
15	160	140	88	121	76
16	180	160	89	144	80
17	205	180	88	169	82
18	230	210	91	196	85
19	260	240	92	225	87
20	290	280	97	256	88
21	320	300	94	289	90
22	355	330	93	324	91
23	390	380	97	361	93
24	425	400	94	400	94
25	460	460	100	441	96
26	500	500	100	484	97
27	540	550	102	529	98
28	585	580	99	576	98
29	630	610	97	625	99
30	675	660	98	676	100
31	720	710	99	728	101
32	770	740	96	784	102
33	820	780	95	841	103
34	875	800	91	900	103
35	925	880	95	961	104
36	980	920	94	1,024	104
37	1,040	1,030	99	1,089	105
38	1,095	1,070	98	1,156	106
39	1,155	1,120	97	1,225	106
40	1,220	1,200	98	1,296	106

1/ International log rule for saws cutting a ¼-inch kerf taken as a standard = 100 percent.

PULPWOOD MEASUREMENT
(Standing Trees)

CORDS

DBH	8-Foot Sticks						
	1	2	3	4	5	6	7
6"	.018	.030	.043				
8"	.032	.050	.070	.092			
10"	.049	.074	.101	.132	.167	.200	.239
12"	.070	.100	.138	.180	.225	.271	.324
14"	.095	.134	.179	.233	.291	.351	.419
16"	.120	.168	.222	.290	.361	.437	.521
18"	.146	.208	.270	.350	.439	.531	.634
20"	.186	.246	.320	.416	.522	.632	.755
22"	.220	.294	.374	.494	.612	.739	.883

TONS*

DBH	8-Foot Sticks						
	1	2	3	4	5	6	7
6"	.045	.075	.108				
8"	.080	.125	.175	.230			
10"	.123	.185	.253	.330	.418	.500	.598
12"	.175	.250	.345	.450	.563	.678	.810
14"	.238	.335	.448	.583	.728	.878	1.048
16"	.300	.420	.555	.725	.903	1.093	1.303
18"	.365	.520	.675	.875	1.098	1.328	1.585
20"	.465	.615	.800	1.040	1.305	1.580	1.888
22"	.550	.735	.935	1.235	1.530	1.848	2.208

*Conversion Factor: 1 Standard Cord = 2.5 Tons.

To find weight for a certain species: (1) determine cords; (2) find species in table on page 19; (3) multiply cords by ratio for that species.

LUMBER SCALE

Thickness & Width (In.)	Length (Feet)					
	6	8	10	12	14	16
	Contents in Board Feet					
1x3	1.5	2	2.5	3	3.5	4
1x4	2	2.6	3.3	4	4.6	5.3
1x5	2.5	3.3	4	5	6	6.6
1x6	3	4	5	6	7	8
1x7	3.5	4.6	6	7	8	9.3
1x8	4	5.3	6.6	8	9.3	10.6
1x10	5	6.6	8.3	10	11.6	13.3
1x12	6	8	10	12	14	16
2x4	4	5.3	6.6	8	9.3	10.6
2x6	6	8	10	12	14	16
2x8	8	10.6	13.3	16	18.6	21.3
2x10	10	13.3	16.6	20	23.3	26.6
2x12	12	16	20	24	28	32
2x14	14	18.6	23.3	28	32.6	37.3
3x6	9	12	15	18	21	24
3x8	12	16	20	24	28	32
3x10	15	20	25	30	35	40
3x12	18	24	30	36	42	48
4x4	8	10.6	13.3	16	18.6	21.3
6x6	18	24	30	36	42	48

STAVE BOLT AND HEADING VOLUMES IN STANDING TREES*

STAVE BOLTS:	Number of 39-inch cuts						
DBH	1	2	3	4	5	6	7
	VOLUME IN CHORD FEET						
12	1.6	3.0					
14	2.8	5.4	7.0				
16	3.3	6.3	8.4	10.0			
18	3.9	7.4	10.7	13.7	16.5	19.1	
20	4.2	8.2	12.1	15.6	18.9	21.9	24.7
22	4.9	9.4	13.6	17.6	21.5	25.0	28.3
24	5.2	10.2	15.1	19.6	23.8	27.8	31.7
26	6.0	11.6	16.8	21.8	26.7	31.2	35.4
28	6.5	12.7	18.7	24.3	29.5	34.5	39.4
30	9.3	16.0	22.5	28.7	34.7	40.3	45.2
32	11.5	21.9	31.2	37.9	44.4	50.6	56.6
34	12.2	24.1	35.6	46.0	55.3	62.0	68.5
36	14.1	27.2	39.4	51.3	62.8	73.2	82.5

HEADING BOLTS:	Number of 24-inch cuts									
DBH	1	2	3	4	5	6	7	8	9	10
	VOLUME IN CHORD FEET									
18	4.6	9.2	13.7	18.1	22.3					
20	5.1	10.2	15.2	20.1	24.9	29.5	34.0	38.4	42.7	
22	5.6	11.2	16.7	22.1	27.3	32.4	37.3	42.0	46.5	50.7
24	6.1	12.0	17.6	22.9	27.9	32.6	37.0	41.0	44.9	48.5
26	6.7	13.1	19.2	25.0	30.5	35.7	40.6	45.2	49.5	53.0
28	7.2	14.1	20.7	27.0	33.0	38.7	44.1	49.2	54.0	58.5
30	7.7	15.1	22.2	29.0	35.5	41.7	47.6	53.2	58.5	63.5
32	8.2	16.1	23.7	31.0	38.0	44.7	51.1	57.2	63.0	68.5

Shortcut Formula
for
10 Factor Prism

$$\frac{\text{\# 39" Cuts X 20}}{\text{Number Points}} = \text{Chord FT/A.}$$

* From: University of Missouri AGR. EX. SVC. CIR 671 and EX. SVC. Kansas State University, 3A-574-4-500.

SHORTCUT FORMULAS
for
Cruising with 10-factor prism or gauge

PULPWOOD
(CORDS)

1. $$\frac{\text{Number of 8-foot sticks in countable trees + number of countable trees}}{\text{2 x number of point samples}} = \text{Cords per acre}$$

2. If trees average 2 or 3 sticks:

$$\frac{\text{Number of 8-foot sticks in countable trees x .7}}{\text{Number of point samples}} = \text{Cords per acre}$$

If trees average 4 sticks or more:

$$\frac{\text{Number of 8-foot sticks in countable trees x .6}}{\text{Number of point samples}} = \text{Cords per acre}$$

3. Cords figure can be converted to tons by using appropriate TONS PER STANDARD CORD FACTOR on page 19.

SHORTCUT FORMULAS
for
Cruising with 10-factor prism or gauge

SAWTIMBER
(INTERNATIONAL RULE)

1. When trees average 1 or 2 16-foot logs:

$$\frac{\text{Number of 16-foot logs in countable trees} \times 650}{\text{Number of point samples}} = \text{Board feet per acre}$$

2. When trees average 2 1/2 or more 16-foot logs:

$$\frac{\text{Number of 16-foot logs in countable trees} \times 600}{\text{Number of point samples}} = \text{Board feet per acre}$$

(DOYLE RULE)

1. Determine volume by International Rule Method then apply following average d.b.h. factor:

Average d.b.h.	Factor
12"	.50
16"	.65
20"	.75
24"	.85
28"	.90
32"	.95

2. $\frac{\text{Number of 16-foot logs in countable trees} \times 500}{\text{Number of point samples}} = \text{Board feet per acre}$

(This works well when trees average 1 1/2 to 2 1/2 logs and 16" - 20" d.b.h.)

COMPUTING VOLUME BY USING BASAL AREA RATIOS

I Board Foot (International) -- Basal Area Ratios by Various Merchantable Lengths

1.0	Log	--	75	B.F.	to	1	Sq.	Ft.
1.5	"	--	100	"	"	"	"	"
2.0	"	--	125	"	"	"	"	"
2.5	"	--	150	"	"	"	"	"
3.0	"	--	175	"	"	"	"	"
3.5	"	--	200	"	"	"	"	"

To obtain board foot volume multiply ratio by number of square feet of basal area involved. This can be used when determining total volume, volume to be removed or growth.

The following formula can be used. It has the advantage of being applicable to any merchantable length including fractions.

25 + (Av. No. of Logs x 50) x B.A. = Board Feet

II Cord -- Basal Area Ratios by Various Merchantable Lengths

1 - 8'	stick	--	.089	Cords	to	1	Sq.	Ft.
2 - "	"	--	.143	"	"	"	"	"
3 - "	"	--	.195	"	"	"	"	"
4 - "	"	--	.249	"	"	"	"	"
5 - "	"	--	.302	"	"	"	"	"

To obtain cord volume multiply ratio by number of square feet of basal area involved. This can be used when determining total volume, volume to be removed or growth.

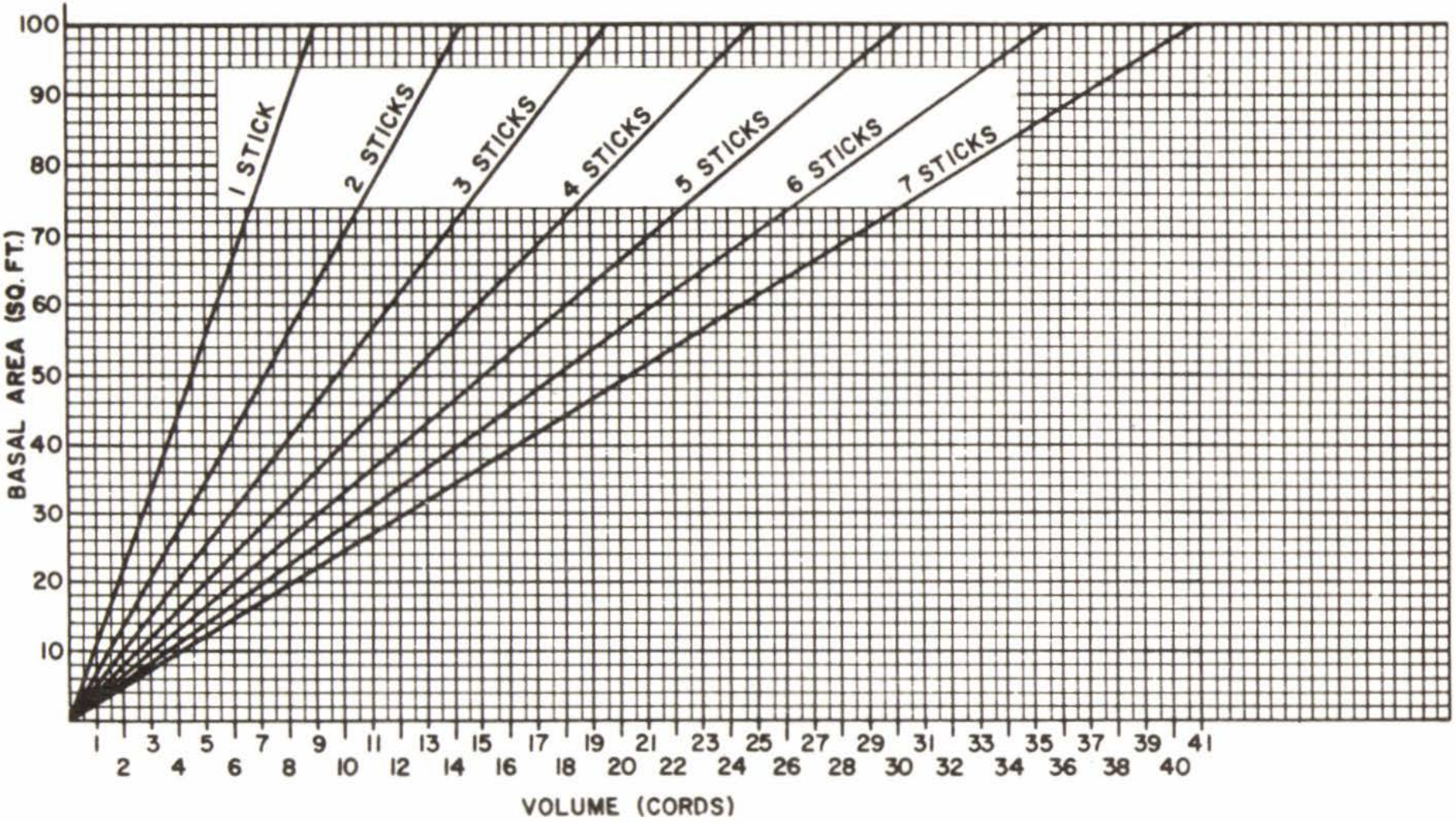
The following formula can be used. It has the advantage of being applicable to any merchantable length including fractions.

.037 + (Av. No. of Sticks x .053) x B.A. = Cords

QUICK CRUISE COMPUTER

VOLUME - CORDS
(1 STICK = 8 FT.)

NA - S & PF
FOREST SERVICE
USDA

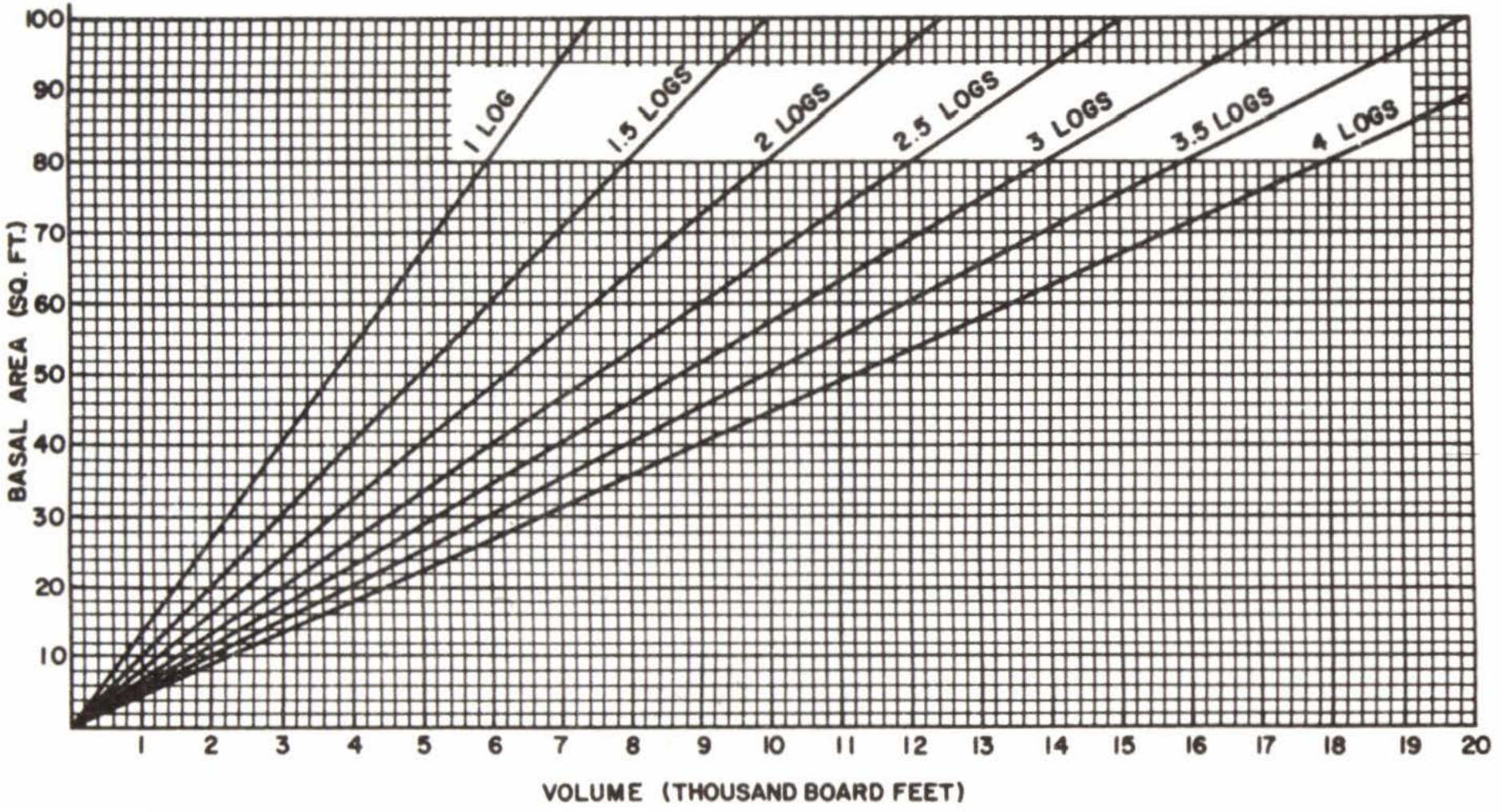


QUICK CRUISE COMPUTER

(VOLUME-BOARD FEET - INT.)

(1 LOG = 16 FT)

NA - S & PF
FOREST SERVICE
USDA

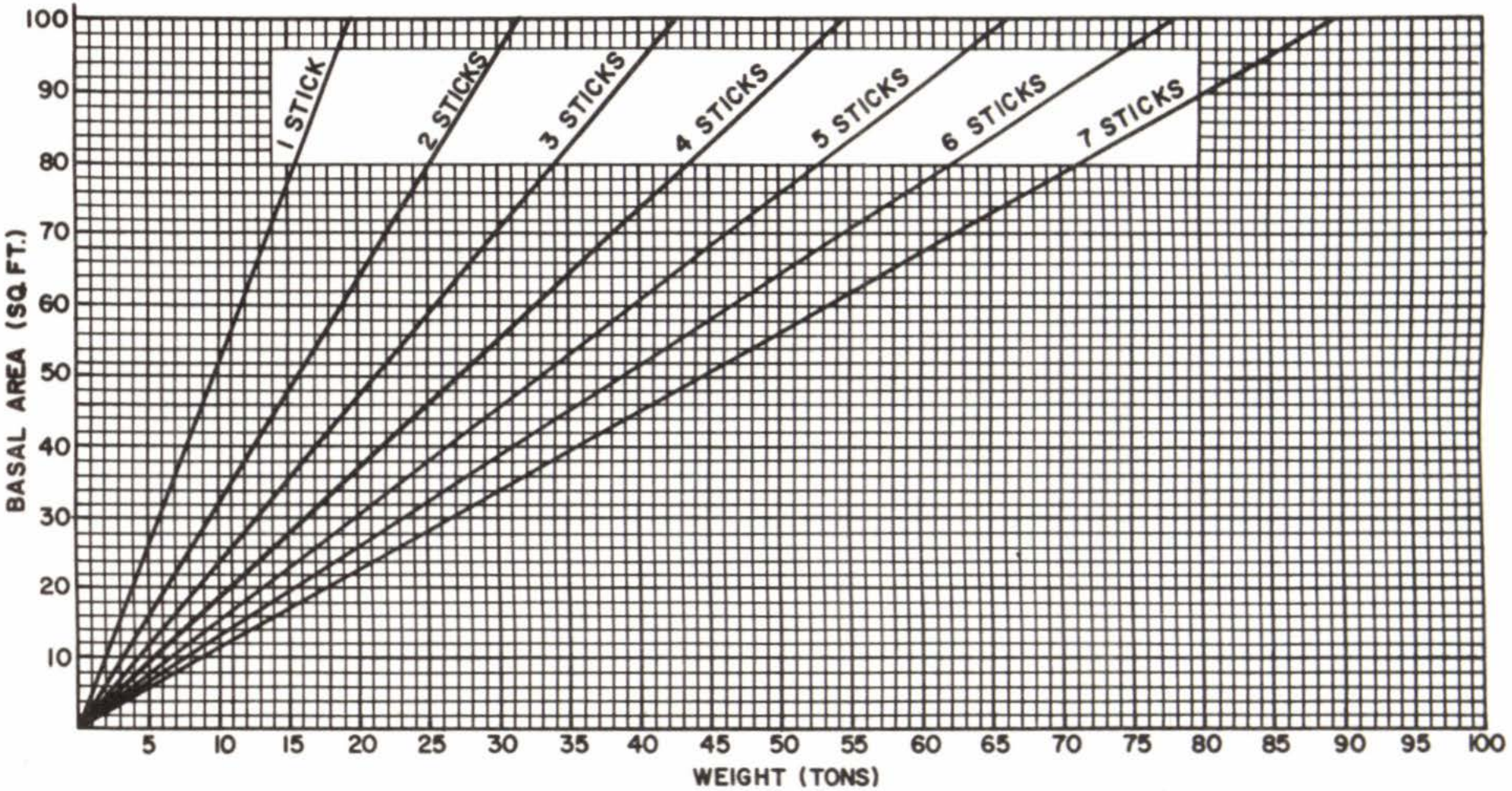


QUICK CRUISE COMPUTER

(WEIGHT - TONS - 2.2 TONS PER CORD)

(1 STICK = 8 FT.)

NA - S & PF
FOREST SERVICE
USDA

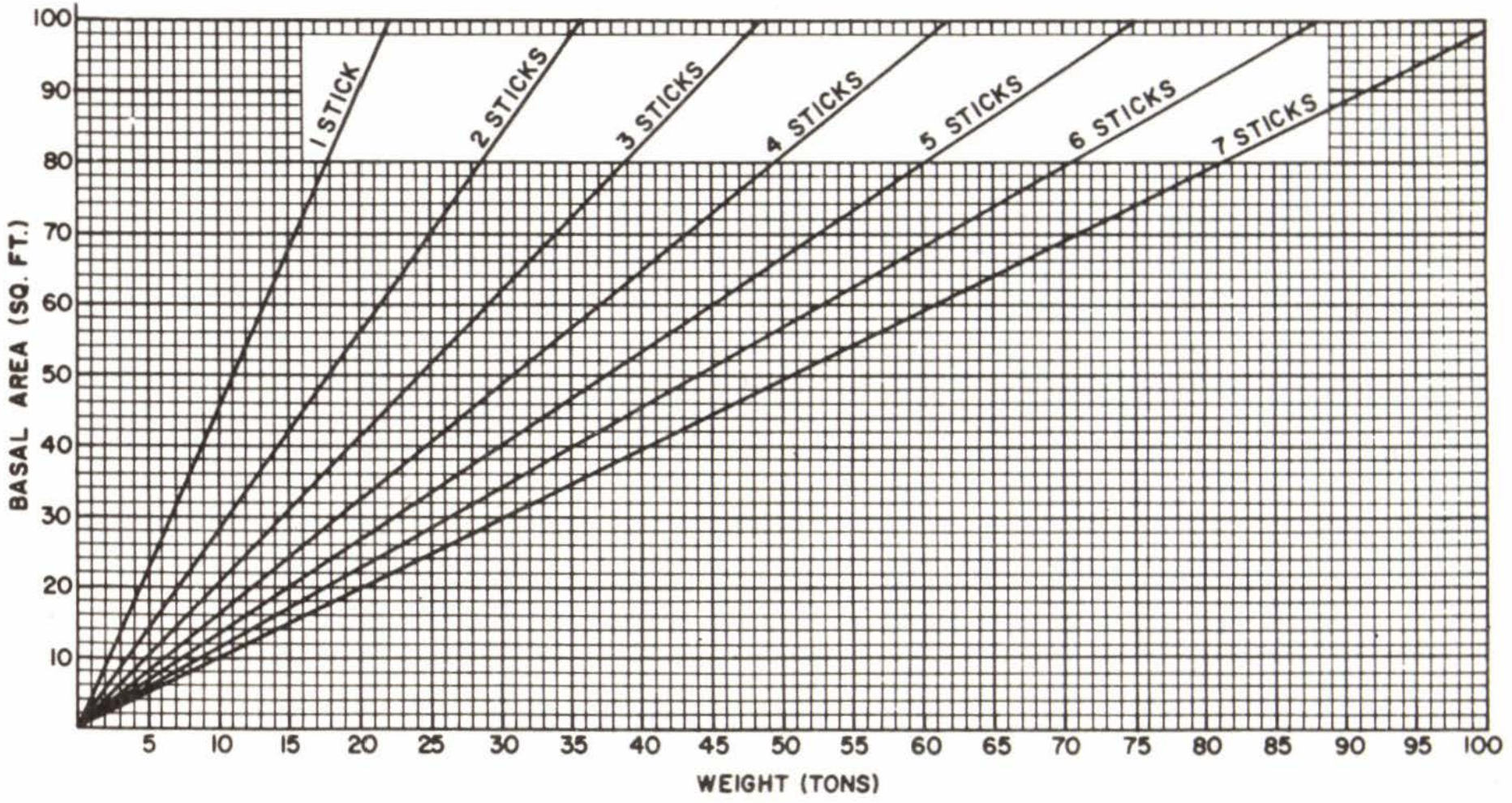


QUICK CRUISE COMPUTER

(WEIGHT - TONS - 2.5 TONS PER CORD)

(1 STICK = 8 FT.)

NA - S & PF
FOREST SERVICE
USDA

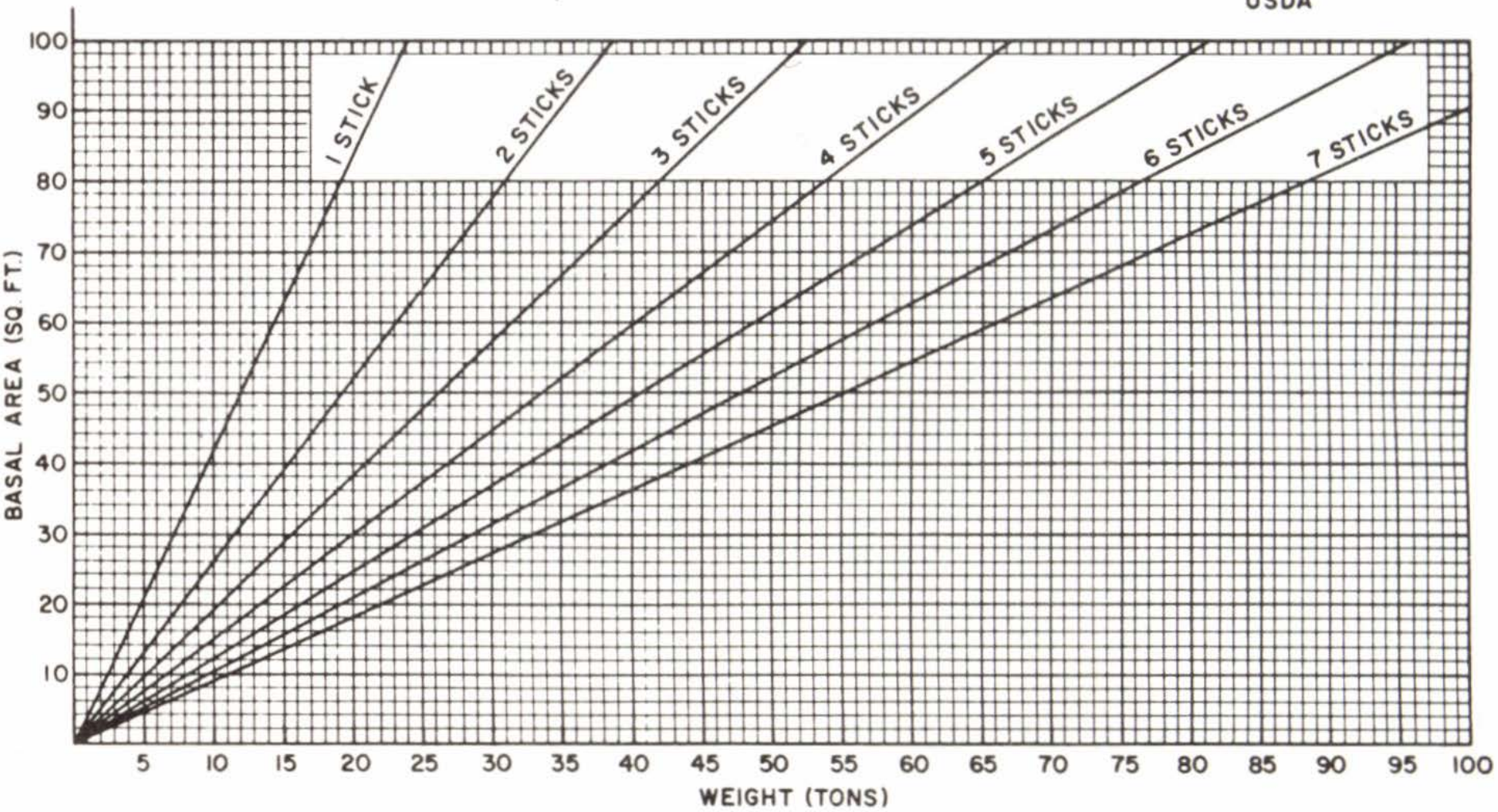


QUICK CRUISE COMPUTER

(WEIGHT - TONS - 2.7 TONS PER CORD)

(1 STICK = 8 FT.)

NA-S & PF
FOREST SERVICE
USDA



WEIGHT TABLE FOR VARIOUS WOODS

	Weight Per Standard Cord (Pounds)	Tons Per Standard Cord Ratio	Weight Per 1000 B.F. of Green Lumber (Pounds)
Ash, white	4300	2.2	4000
Aspen	3900	2.0	3600
Basswood	3800	1.9	3500
Beech	4900	2.5	4500
Birch, yellow	5100	2.6	4800
Birch, white	4500	2.3	4200
Cedar, red	3300	1.7	3100
Cedar, N. white	2500	1.3	2300
Cherry, black	4000	2.0	3800
Cottonwood	4400	2.2	4100
Elm	5000	2.5	4600
Gum, red & black	4500	2.3	4200
Hackberry	4500	2.3	4200
Hemlock	4500	2.3	4200
Hickory	5700	2.9	5300
Locust, black	5200	2.6	4800
Maple, hard	5300	2.7	4600
Maple, soft	4300	2.2	3900
Oak, red	5700	2.9	5200
Oak, white	5600	2.8	5200
Pine, red	3800	1.9	3500
Pine, shortleaf	4700	2.4	4300
Pine, white	3200	1.6	3000
Poplar, yellow	3400	1.7	3200
Spruce	3000	1.5	2800
Sycamore	4700	2.4	4300
Tamarack	4200	2.1	3900
Walnut, black	5200	2.6	4800

SUGAR MAPLE TAP HOLE COMPUTATION SHEET
POINT-SAMPLE METHOD
(10-Factor)

D.B.H.																TOTAL
10"	18	37	55	73	92	110	128	146	165	183	201	220	238	256	275	
12"	13	25	38	51	64	76	89	102	114	127	140	152	165	178	191	
14"	9	19	28	38	47	56	66	75	85	94	103	113	122	132	141	
16"	14	29	43	58	72	86	101	115	130	144	158	173	187	202	216	
18"	11	23	34	46	57	68	80	91	103	114	125	137	148	160	171	
20"	14	28	41	55	69	83	97	110	124	138	152	166	179	193	207	
22"	11	23	34	46	57	68	80	91	103	114	125	137	148	160	171	
24"	10	19	29	38	48	58	67	77	86	96	106	115	125	134	144	
26"	11	22	32	43	54	65	76	86	97	108	119	130	140	151	162	
TOTAL																

For number of tap holes per acre--total last numbers in each diameter class--divide this total by number of point samples taken.

(Total) _____

_____ = _____ tap holes per acre

_____
(Point samples)

(Tap holes per acre) _____ x (acres) _____ = _____ total for woodland

RATE OF GROWTH
(GROWTH FACTOR TABLE)

DBH	Rings Per Inch											
	4	5	6	7	8	9	10	11	12	13	14	15
4"	.282	.225	.188	.161	.141	.125	.113	.102	.094	.087	.080	.075
5"	.220	.177	.147	.126	.110	.098	.088	.080	.073	.068	.063	.059
6"	.181	.145	.121	.103	.091	.080	.072	.065	.060	.056	.052	.048
7"	.153	.123	.103	.088	.077	.068	.061	.056	.051	.047	.044	.041
8"	.133	.106	.089	.076	.067	.059	.053	.048	.044	.041	.038	.035
9"	.116	.093	.078	.067	.058	.052	.047	.042	.039	.036	.033	.031
10"	.105	.084	.070	.060	.053	.047	.042	.038	.035	.032	.030	.028
11"	.095	.076	.063	.054	.047	.042	.038	.034	.032	.029	.027	.025
12"	.087	.070	.058	.050	.044	.039	.035	.032	.029	.027	.025	.023
13"	.080	.064	.053	.046	.040	.035	.032	.029	.027	.025	.023	.021
14"	.074	.059	.049	.042	.037	.033	.030	.027	.025	.024	.021	.020
15"	.069	.055	.046	.039	.034	.031	.028	.025	.023	.021	.020	.018
16"	.064	.052	.043	.037	.032	.029	.026	.023	.021	.020	.018	.017
17"	.061	.048	.040	.035	.030	.027	.024	.022	.020	.019	.017	.016
18"	.057	.046	.038	.033	.029	.025	.023	.021	.019	.018	.016	.015
19"	.054	.043	.036	.031	.027	.024	.022	.020	.018	.017	.015	.014
20"	.051	.041	.034	.029	.025	.023	.020	.019	.017	.016	.015	.014
21"	.049	.039	.033	.028	.024	.022	.020	.018	.016	.015	.014	.013
22"	.046	.037	.031	.027	.023	.021	.019	.017	.015	.014	.013	.012

Procedure

1. Determine GROWTH FACTOR by applying average d.b.h. and average rings per inch to above table.
2. Compute annual rate of growth of BASAL AREA, CORDS, TONS, BOARD FEET (International), or CUBIC FEET by multiplying amount of good growing stock in each category by the GROWTH FACTOR.

SHORTCUT CALCULATIONS FOR GROWTH

1. Rule-of-Thumb for Central Hardwoods:

$$\text{Annual growth rate (board feet)} = \text{No. of trees per acre above 9"} \times \begin{matrix} 5 - \text{good site} \\ 4 - \text{average site} \\ 3 - \text{poor site} \end{matrix}$$

2. Quick Growth Computation for an Individual Tree:

$$\text{Annual growth} = \frac{\text{Future volume after increment of 2"} - \text{present volume}}{\text{Growth rate (RPI)}}$$

3. Shortcut Growth Formulas:

a. $\frac{4}{\text{DBH} \times \text{RPI}} \times 100 = \%\ \text{Growth}$

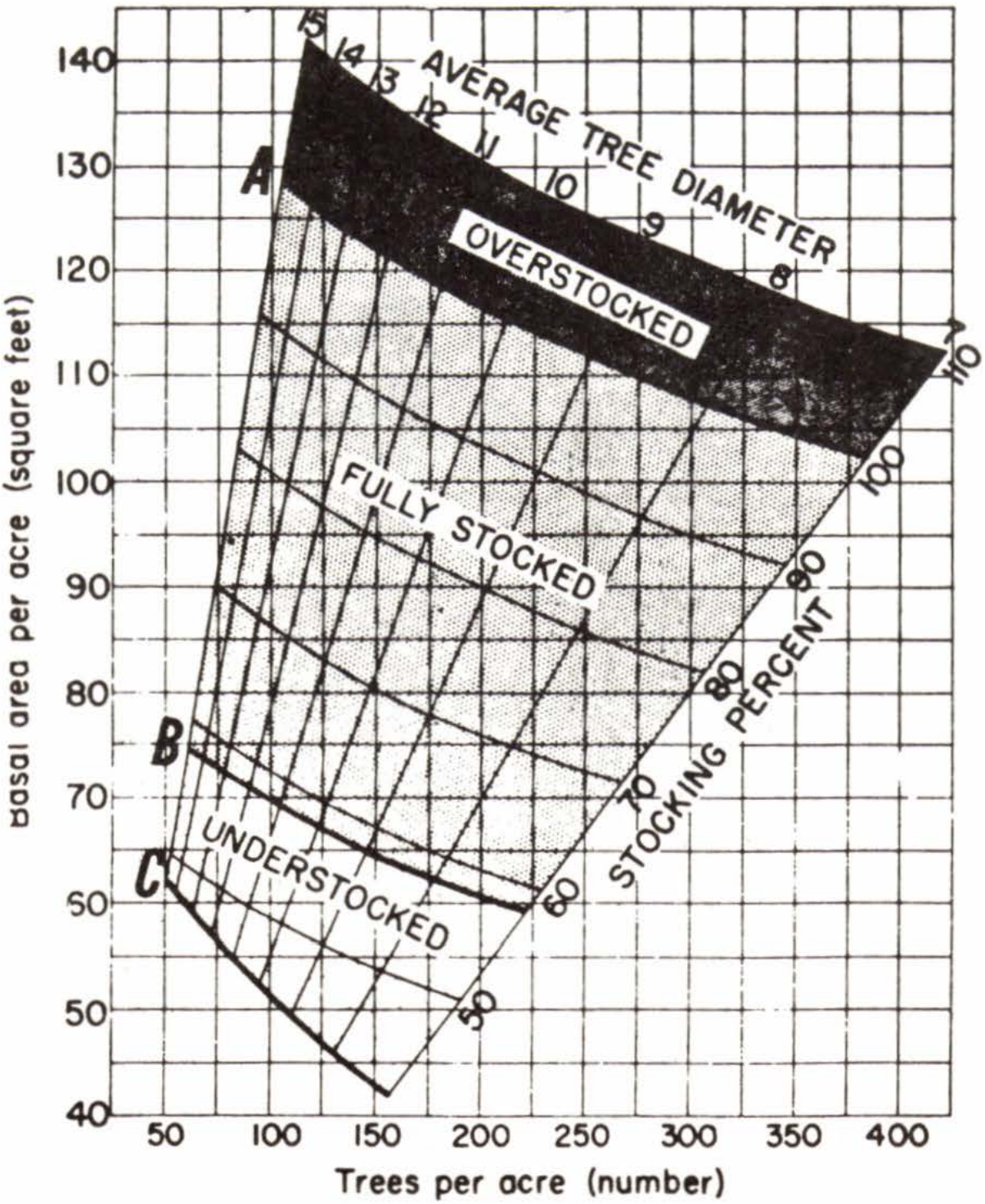
b. $\frac{\text{Vol. Per Acre} \times 4}{\text{DBH} \times \text{RPI}} = \text{Growth/Acre/Year(Volume)}$

c. $\frac{\text{Basal Area per Acre} \times 4}{\text{DBH} \times \text{RPI}} = \text{Growth/Acre/Year(Basal Area)}$

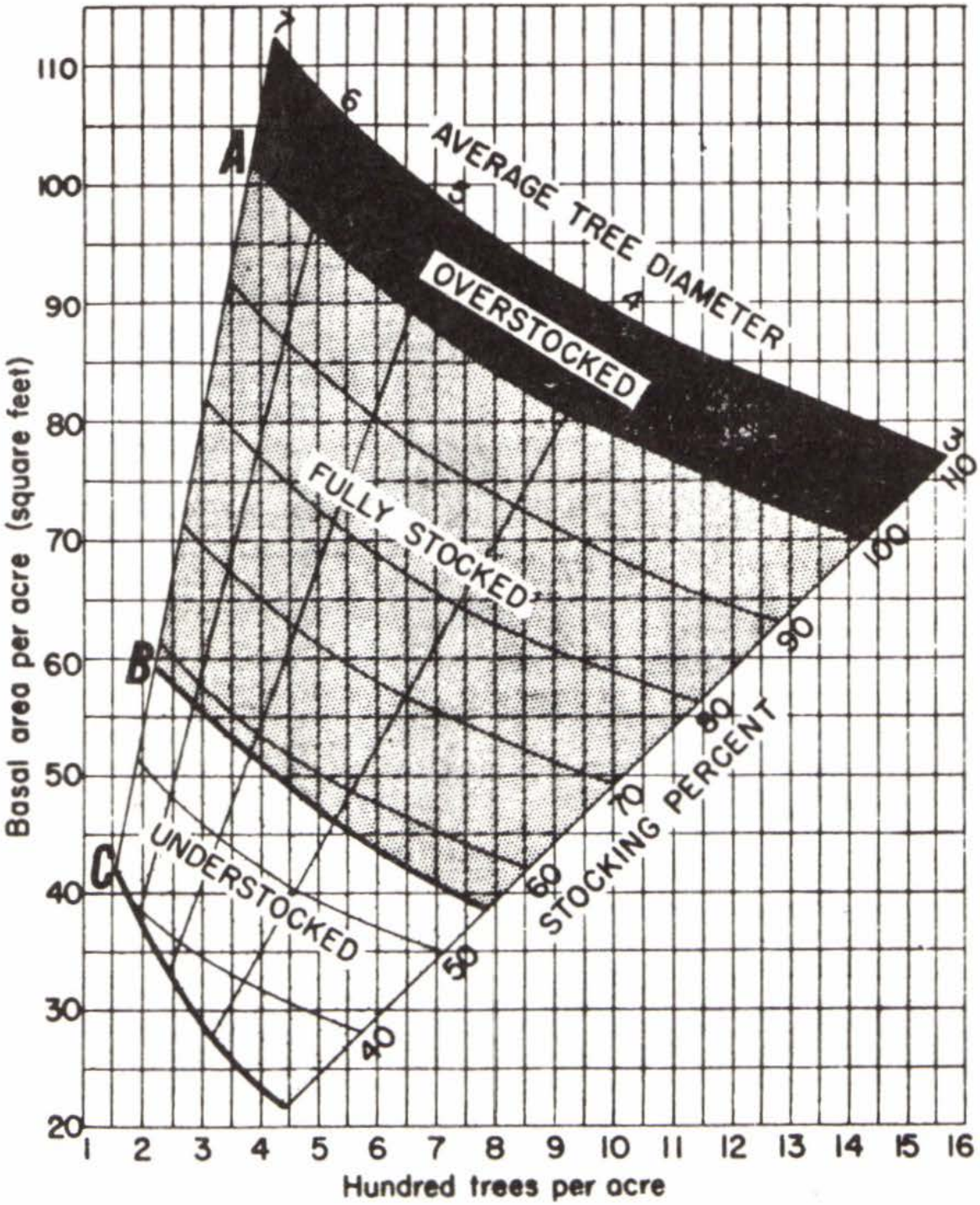
4. Ingrowth Computation When Using Point Sample Cruising

$$\frac{\text{Basal Area in 10" Trees} \times 91.5}{\text{Rings Per Inch}} = \text{Board Feet/Acre}$$

FIGURE 1.—Relation of basal area, number of trees, and average tree diameter to stocking percent for upland central hardwoods. Tree-diameter range 7-15 (left), 3-7 (right). The area between curves A and B indicates the range of stocking where



trees can fully utilize the site. Curve C shows the lower limit of stocking necessary to reach the B level in 10 years on average sites. (Average tree diameter is the diameter of the tree of average basal area.)



CENTRAL HARDWOOD SPACING TABLE

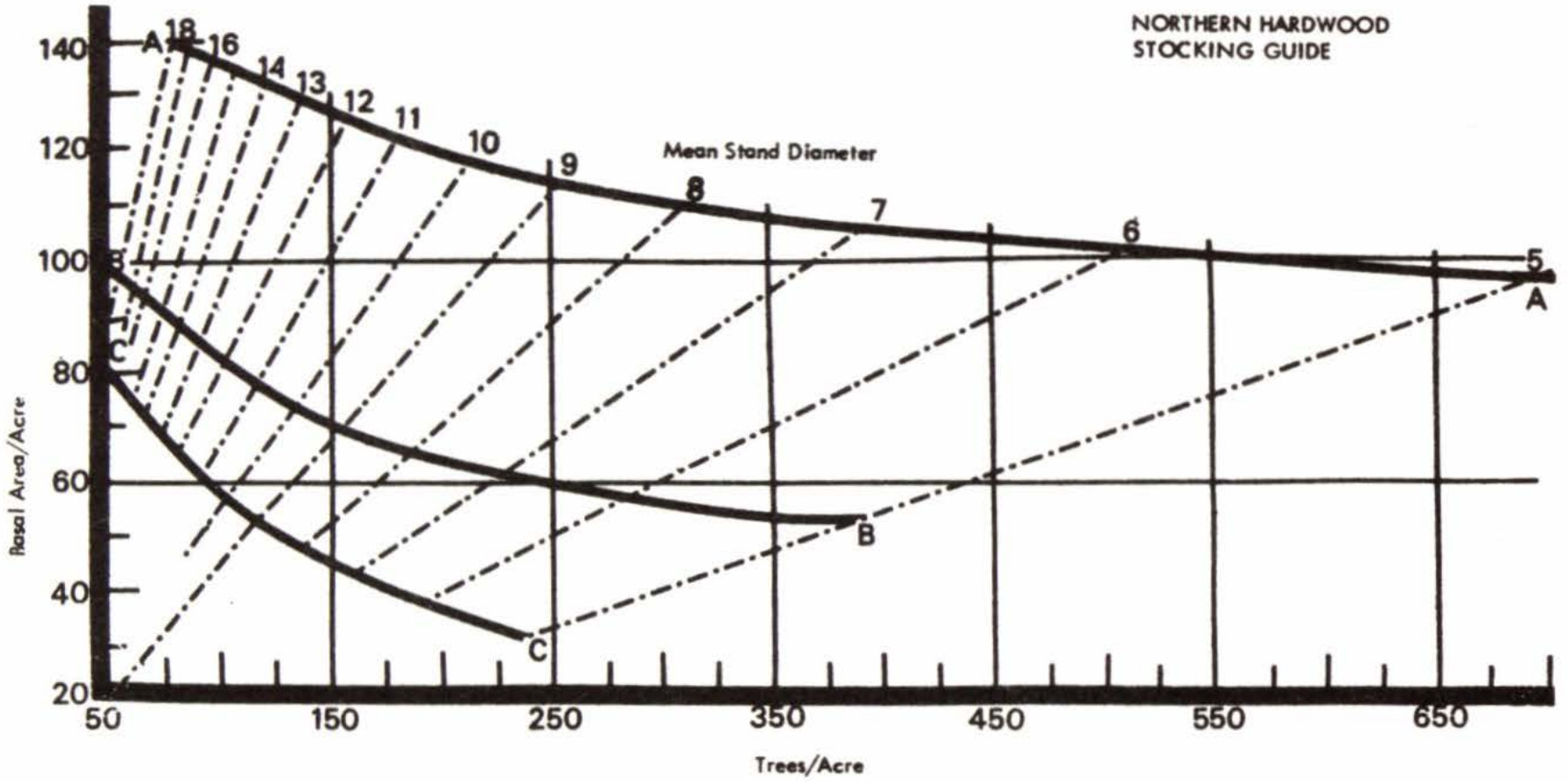
Diameter (Inches)	Maximum Stocking "A"-Level Spacing (feet)	Minimum Stocking "B"-Level Spacing (feet)
2	4.6	6.5
3	6.1	8.2
4	7.6	9.9
5	9.0	11.6
6	10.3	13.4
7	11.6	15.0
8	13.0	17.0
9	14.3	18.7
10	15.6	20.4
11	17.0	22.1
12	18.1	23.8
13	19.4	25.6
14	20.8	27.2
15	21.9	29.0

RULE-OF-THUMB:

For "A"-level stocking spacing, multiply diameter by 1.5

For "B"-level stocking spacing, multiply diameter by 2.0

Stocking guides for even-aged northern hardwoods based on number of trees in the main canopy, average diameter, and basal area per acre. Stands above the A-line are overstocked. Stands between the A- and B-line are adequately stocked. Stands between the B- and C-line should be adequately stocked within 10 years. Stands below the C-line are definitely understocked.



TSI RULES OF THUMB
and
ROUGH AVERAGE FIGURES
(Frill & Spray Method)

1. Output for one man day is 800 diameter inches or 50 to 60 square feet of basal area.

2. One gallon of 2,4,5-T will treat 2200 diameter inches or 150 to 160 square feet of basal area.

3. One gallon of 2,4,5-T will be used for 22 man hours of TSI work.

4. At present cost for 2,4,5-T ($15.00/gal.) and fuel oil ($.40/gal.), costs for performing TSI by different labor rates are:

Labor Rate/Hour	*Cost/D. In.	*Cost/Sq. Ft.
$2.00	3¢	41¢
3.00	4¢	55¢
4.00	5¢	69¢
5.00	6¢	82¢

*Cost run higher for trees under 10" d.b.h.

ESTIMATED COST PER TREE FOR PRUNING PINE

Height (feet)	Hourly Rate $2.00	$3.00	$4.00	$5.00
6	$.107	$.161	$.214	$.268
7	.120	.180	.240	.300
8	.133	.200	.266	.333
9	.146	.219	.292	.365
10	.160	.240	.320	.400
11	.186	.279	.372	.465
12	.213	.320	.426	.533
13	.240	.360	.480	.600
14	.280	.420	.560	.700
15	.320	.480	.640	.800
16	.360	.540	.720	.900
17	.400	.600	.800	1.000

RULE-OF-THUMB: Estimate of number of years before clear wood is added after pruning pine --
Diameter of wound (inches) x Growth rate (RPI)

COMPOUND INTEREST TABLE

Years	4%	5%	6%	7%	8%	9%	10%
1	1.040	1.050	1.060	1.070	1.080	1.090	1.100
2	1.082	1.103	1.124	1.145	1.166	1.188	1.210
3	1.125	1.158	1.191	1.225	1.260	1.295	1.331
4	1.170	1.216	1.262	1.311	1.361	1.412	1.464
5	1.217	1.276	1.338	1.403	1.469	1.539	1.611
6	1.265	1.340	1.419	1.501	1.587	1.677	1.772
7	1.316	1.407	1.504	1.606	1.714	1.828	1.949
8	1.369	1.478	1.594	1.718	1.851	1.993	2.144
9	1.423	1.551	1.689	1.839	1.999	2.172	2.358
10	1.480	1.629	1.791	1.967	2.159	2.367	2.594
15	1.801	2.079	2.397	2.759	3.172	3.642	4.177
20	2.191	2.653	3.207	3.870	4.661	5.604	6.728
25	2.666	3.386	4.292	5.428	6.849	8.623	10.83
30	3.243	4.322	5.744	7.612	10.06	13.27	17.45
35	3.946	5.516	7.686	10.68	14.79	20.41	28.10
40	4.801	7.040	10.29	14.98	21.73	31.41	45.26
45	5.841	8.985	13.77	21.00	31.92	48.33	72.89
50	7.107	11.47	18.42	29.46	46.90	74.35	117.4
55	8.646	14.64	24.65	41.32	68.92	114.4	189.1
60	10.52	18.68	32.99	57.95	101.3	176.0	304.5
65	12.80	23.84	44.14	81.27	148.8	270.8	490.4
70	16.57	30.43	59.08	114.0	218.6	416.7	789.7
75	18.95	38.83	79.06	159.9	321.2	641.1	1272.0
80	23.05	49.56	105.8	224.2			

NUMBER OF TREES PER ACRE BY VARIOUS METHODS OF SPACING

Spacing (feet)	Trees (number)	Spacing (feet)	Trees (number)	Spacing (feet)	Trees (number)
2x2	10,890	7x9	691	12x15	242
3x3	4,840	7x10	622	12x18	202
4x4	2,722	7x12	519	12x20	182
4x5	2,178	7x15	415	12x25	145
4x6	1,815	8x8	681	13x13	258
4x7	1,556	8x9	605	13x15	223
4x8	1,361	8x10	544	13x20	168
4x9	1,210	8x12	454	13x25	134
4x10	1,089	8x15	363	14x14	222
5x5	1,742	8x25	218	14x15	207
5x6	1,452	9x9	538	14x20	156
5x7	1,245	9x10	484	14x25	124
5x8	1,089	9x12	403	15x15	194
5x9	968	9x15	323	15x20	145
5x10	871	10x10	436	15x25	116
6x6	1,210	10x12	363	16x16	170
6x7	1,037	10x15	290	16x20	136
6x8	908	10x18	242	16x25	109
6x9	807	11x11	360	18x18	134
6x10	726	11x12	330	18x20	121
6x12	605	11x15	264	18x25	97
6x15	484	11x20	198	20x20	109
7x7	889	11x25	158	20x25	87
7x8	778	12x12	302	25x25	70

BASAL AREA TABLE

Diameter (Inches)	Area (Sq.Ft.)	Diameter (Inches)	Area (Sq.Ft.)
1	.006	21	2.405
2	.022	22	2.640
3	.049	23	2.885
4	.087	24	3.142
5	.136	25	3.41
6	.196	26	3.69
7	.267	27	3.98
8	.349	28	4.28
9	.442	29	4.59
10	.545	30	4.91
11	.660	31	5.24
12	.785	32	5.59
13	.922	33	5.94
14	1.069	34	6.30
15	1.227	35	6.68
16	1.396	36	7.07
17	1.576	37	7.47
18	1.767	38	7.88
19	1.969	39	8.30
20	2.181	40	8.73

TREE REQUIREMENTS

Requirements for moisture (M), nutrients (N), heat (H), and light (L) in relative values from 1 (least) to 5 (greatest).

	Relative Values			
	M	N	H	L
Balsam Fir	3.6	2.0	1.4	2.0
White Spruce	2.8	2.2	1.5	2.3
Black Spruce	4.5	1.2	1.0	3.5
Jack Pine	1.0	1.1	1.9	5.0
Red Pine	1.1	1.6	2.1	4.5
White Pine	1.7	2.1	2.0	2.8
Northern White-cedar	4.2	2.3	1.3	1.2
Tamarack	5.0	1.0	1.0	5.0
Eastern Redcedar	1.0	2.6	5.0	3.0
Boxelder	3.3	5.0	5.0	3.4
Red Maple	1.9	2.3	2.6	3.4
Sugar Maple	3.2	5.0	3.5	1.0
Silver Maple	3.2	5.0	5.0	4.5
Yellow Birch	3.7	5.0	2.4	1.7
Paper Birch	2.9	2.1	1.7	5.0
Bitternut Hickory	2.7	5.0	4.8	1.0
Hackberry	3.3	5.0	5.0	1.6
Black Ash	3.9	3.5	2.6	1.8
Green Ash	3.0	5.0	4.4	3.6
Black Walnut	1.6	5.0	5.0	2.0
Ironwood	2.4	5.0	4.3	1.1
Balsam Poplar	3.7	2.7	2.1	3.5
Cottonwood	2.9	5.0	5.0	3.9
Bigtooth Aspen	1.3	3.0	3.1	3.4
White Oak	2.1	5.0	4.6	1.3
Northern Pin Oak	1.0	1.8	3.0	5.0
Bur Oak	1.5	3.2	3.8	3.5
Northern Red Oak	1.5	4.2	3.5	2.8
Basswood	2.5	5.0	3.8	1.5
Amercian Elm	3.5	5.0	3.9	2.0
Rock Elm	2.9	5.0	5.0	2.6
Quaking Aspen	2.0	2.3	2.1	4.2

NUMBER OF STEMS PER ACRE
by
Diameter and Basal Area

B.A.	Average Diameter															
Sq.Ft.	3"	4"	5"	6"	7"	8"	9"	10"	11"	12"	14"	16"	18"	20"	22"	24"
10	204	115	74	51	38	29	23	18	15	12.7	9.4	7.2	5.7	4.6	3.8	3.2
20	408	230	147	102	75	58	45	37	30	25.5	18.7	14.3	11.3	9.2	7.6	6.4
30	612	345	221	153	112	86	68	55	45	38.2	28.1	21.5	17.0	13.7	11.4	9.5
40	816	460	294	204	150	115	90	73	61	50.9	37.4	28.6	22.6	18.3	15.2	12.7
50	1020	575	368	255	187	143	113	92	76	63.7	46.8	35.8	28.3	22.9	19.0	15.9
60	1225	690	441	306	225	172	136	110	91	76.4	56.1	43.0	34.0	27.5	22.7	19.1
70	1429	805	515	357	262	201	158	128	106	89.1	65.5	50.1	39.6	32.1	26.5	22.3
80	1633	920	588	408	300	229	181	147	121	101.8	74.8	57.3	45.3	36.6	30.3	25.4
90	1835	1034	662	459	337	258	204	165	135	114.6	84.2	64.4	50.9	41.2	34.1	28.6
100	2041	1149	735	510	375	287	226	183	152	127.3	93.5	71.6	56.6	45.8	37.9	31.8